G. MESTA.

BLOWING ENGINE OR COMPRESSOR.

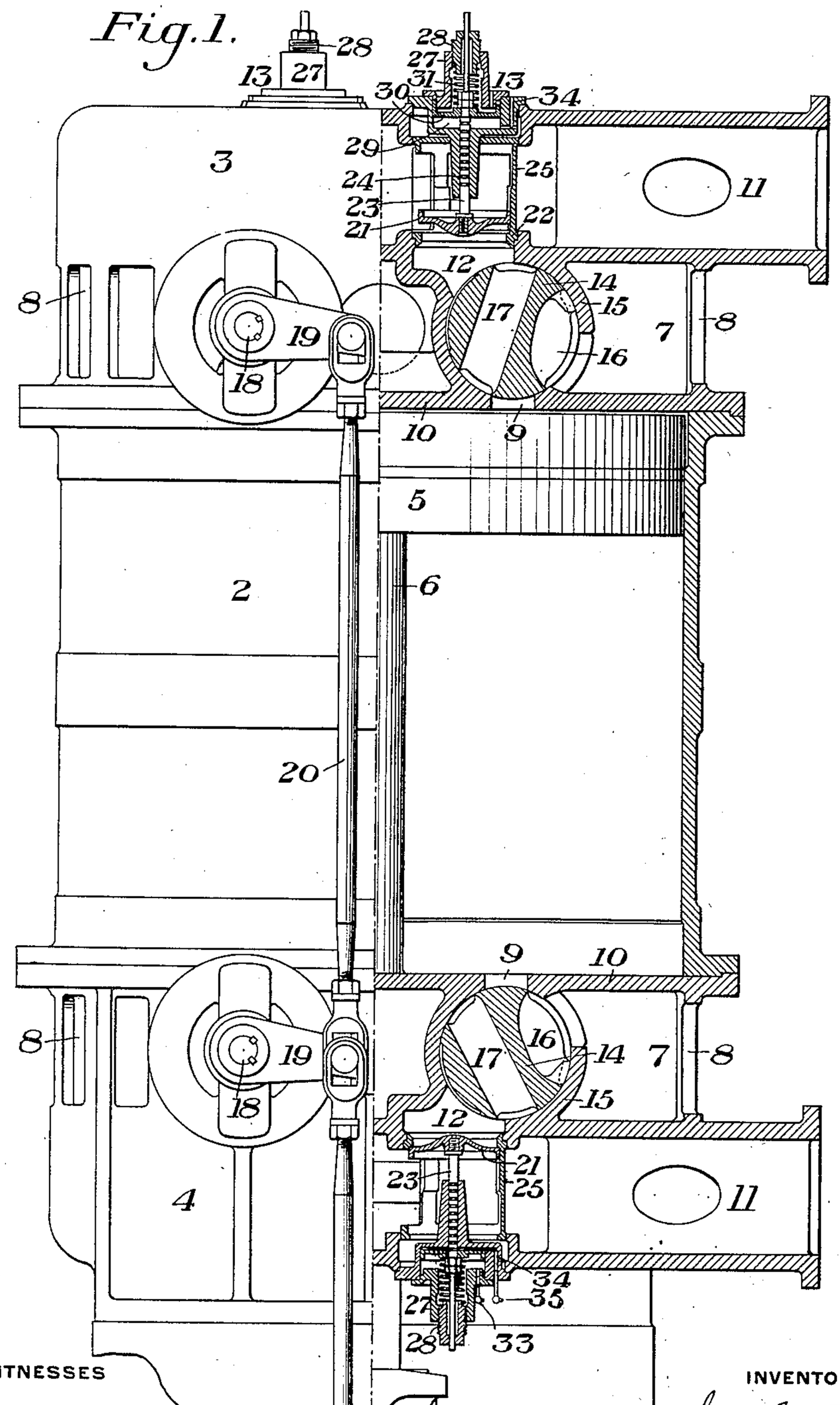
APPLICATION FILED AUG. 4, 1909.

958,705.

Patented May 17, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



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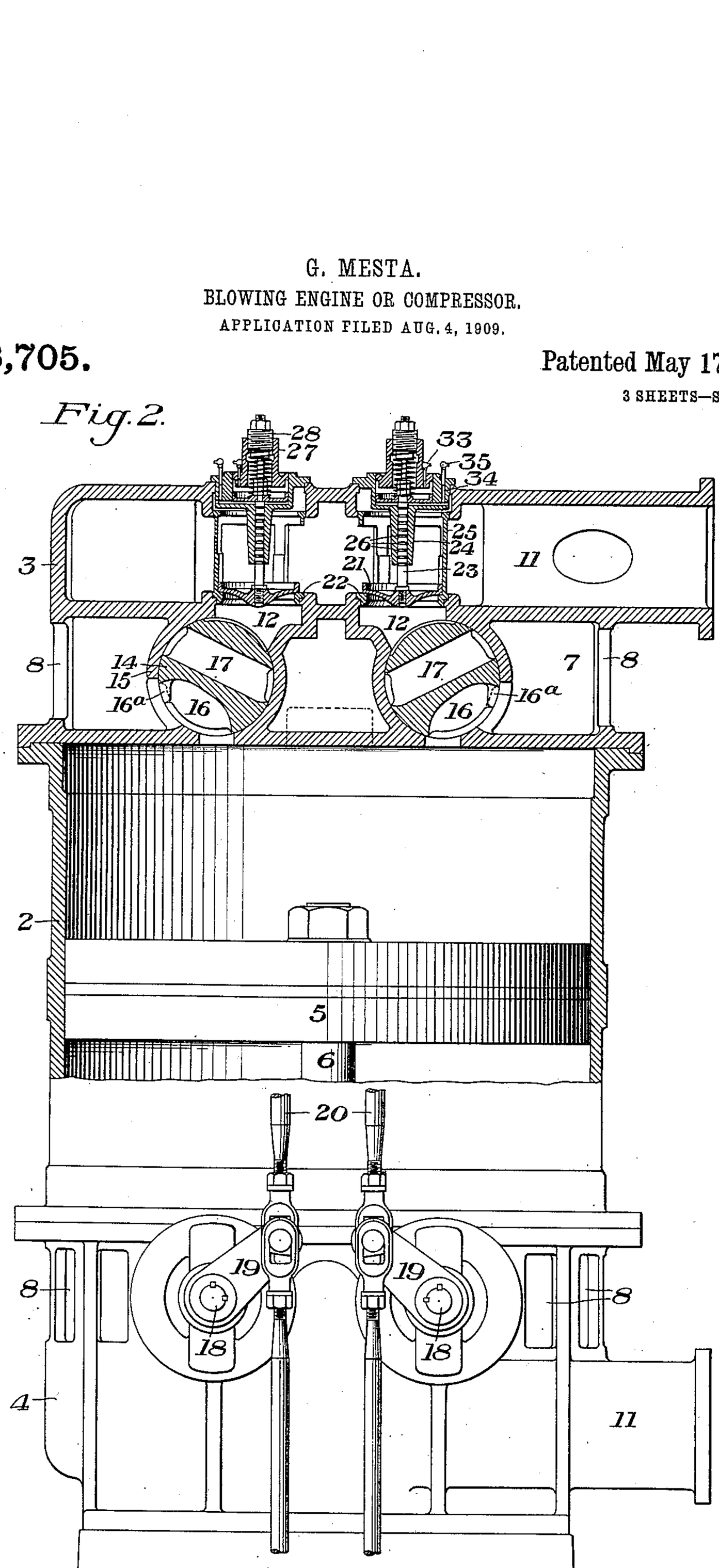
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

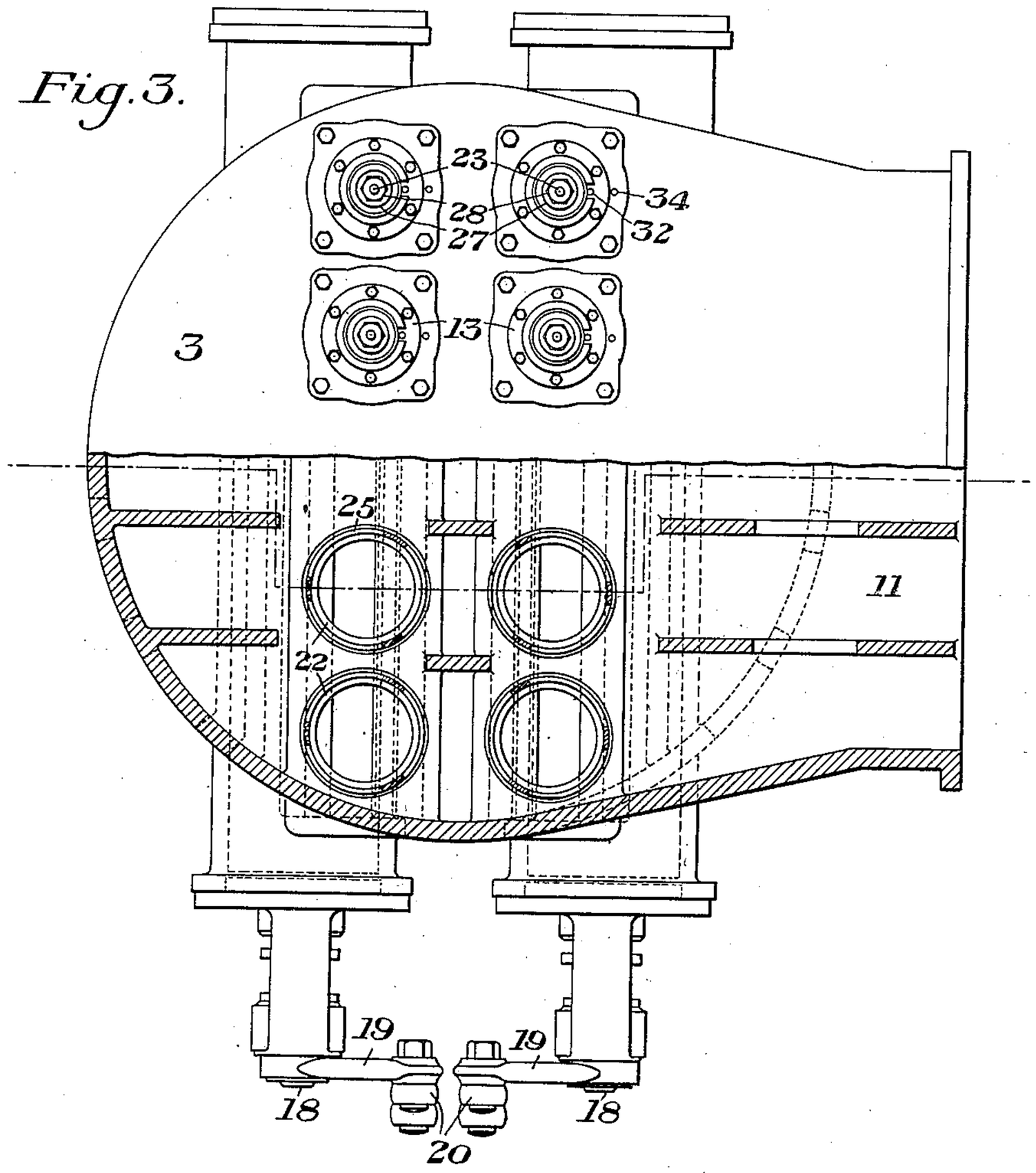
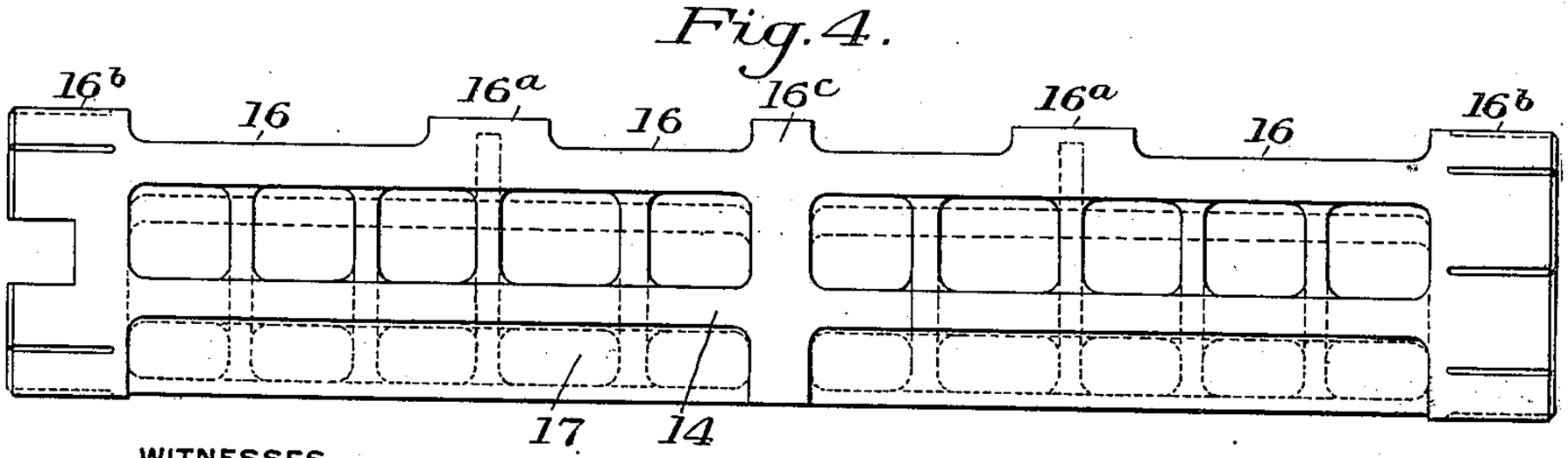


Fig. 4.



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UNITED STATES PATENT OFFICE.

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BLOWING-ENGINE OR COMPRESSOR.

958,705. Specification of Letters Patent. Patented May 17, 1910.

Application filed August 4, 1909. Serial No. 511,191.

To all whom it may concern:

Be it known that I, GEORGE MESTA, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Blowing-Engines or Compressors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a view partly in side elevation and partly in section of a portion of a blowing engine embodying my invention, showing the engine piston at the limit of one of its compression strokes; Fig. 2 is a view showing one end portion of the engine in section and the other end portion in side elevation with the piston at an intermediate point in its return stroke; Fig. 3 is a view partly in elevation and partly in section; and Fig. 4 is a plan view of one of the combined inlet and outlet valves removed.

My invention has relation to blowing engines or compressors, and more particularly to improved valve mechanism therefor. In this art, high speed is becoming more and more important in order to reduce the cost per unit of output. In order to secure a high-speed, two features are of primary importance: first, large areas through the inlet and outlet valves, together with small clearance volumes; and, second, reliability and absence of shocks in the movement of the valves.

My invention relates to that type of compressor in which smoothness of valve motion is obtained by interposing a positively actuated valve between the compressor cylinder and the puppet discharge valves. This general arrangement of parts has in itself been known since as early as 1885, and is, therefore, not claimed by me as an invention; but my invention is an improvement on this type of compressors, whereby the efficiency of the same is increased, particularly for use as blowing engines.

As before stated, large inlet and outlet areas and small clearances are essential. I obtain this combination of features by utilizing both halves of each cylinder head for the ports, and using the same ports in part for both inlet and outlet. To minimize clearance and friction losses, I extend the outlet port between the cylinder and puppet valve straight through the positively actuated valve, thereby obviating change of direction in the flow of the air between the cylinder and the puppet valve. In order to further reduce friction and clearance volume, I increase the ratio of the width of the ports in the outlet valve to the diameter of the same valve in a much greater extent than ever heretofore attempted. As a result of this, the valve when opened to the atmosphere or to the inlet passage is supported upon only a very small portion of its periphery. This has a tendency to deform the valve and cause binding, wear and more or less rapid destruction. To overcome this difficulty, and at the same time to provide free and unobstructed flow through the valve, I provide the latter with circumferential ribs or flaps, which act to extend the bearing for the valve and form a support therefor in the middle of its otherwise unsupported span, until such time as the valve is turned far enough to increase the extent of its natural support beyond the port.

All positive operating means are more or less subject to misadjustment. In blowing engines, quick stoppage for repairs is not feasible, and if the rotary valve is not properly adjusted, slamming of the discharge valves will occur. To prevent breakage under these conditions, I employ a discharge valve having dash-pot means which cushion the valve during both its opening and closing motions.

The precise nature of my invention and the manner in which the foregoing and other minor objects are attained will be best understood by reference to the accompanying drawings, which will now be described and which illustrate the preferred embodiment of my invention, it being premised, however, that various changes may be made in the details of construction and arrangement of the parts, without departing from the spirit and scope of my invention, as defined in the appended claims.

In these drawings, the numeral 2 designates the tub or cylinder of the engine, and 3 and 4 the cylinder heads. 5 designates the engine piston, and 6 the piston rod.

The two heads 3 and 4, together with the arrangement of inlet and discharge ports and valves now to be described, are preferably the same at both ends of the cylinder,

and the description will therefore be confined to the construction and arrangement at one end and similar reference characters will be applied to corresponding parts at the opposite end.

Each head is provided with the inlet chambers 7, which are supplied by the inlet ports 8 and which communicate with the end of the cylinder through the ports 9, which extend transversely through the inner wall 10 of the cylinder head. 11 designates the outlet chamber or passage which communicates with the ports 9, through the ports or passages 12, and through the automatic discharge valves 13 and the combined inlet and auxiliary discharge valves 14. The valves 14 are of the rotary cylindrical type, being mounted in the cylindrical cages or seats 15. Each of these valves has a cut away portion or port 16, which is designed in one position of the valve to connect the port 9 with the inlet chamber 7, and also a port 17, which, in the other position of the valve, is designed to connect the port 9 with the space or chamber 12, between the valve 14 and the automatic discharge valve 13. The two valves 14 are arranged side by side to control the respective ports 9, and a plurality, in the present instance four, of the automatic discharge valves 13 are employed in connection with each of the valves 14. The stems 18 of the valves 14, are extended exteriorly of the heads at one end and are provided with the rocker arms 19, connected to the actuating rods 20, which are connected to the straps of the usual eccentrics on the engine shaft. Each of the rods 20 is connected to one of the valves at each end of the cylinder, the two rods being arranged side by side and actuated in unison. Each of the valves 14, is, in accordance with my invention, provided at one of the edges of the inlet port 16, with one or more projecting lips or flaps 16^a, extending into said port.

As shown in detail in Fig. 4, the valve body preferably has continuous end bearing surfaces 16^b and a continuous central bearing surface 16^c. I preferably arrange one or more of the lips or flaps 16^a between the central bearing surface 16^c and each end bearing surface 16^b. By reference to Figs. 1 and 2, it will be readily seen that these lips or flaps act to increase the support of the valves against the force of the blast pressure at the time when they are just opening to the atmosphere, and before they have turned sufficiently far to have their full natural support. This feature greatly strengthens the valves and prevents binding and wear thereof.

The automatic discharge valves 13 are puppet valves and while they may be of various forms, I prefer to construct and arrange them substantially in the manner shown in the drawings. As they are shown, each of these valves consists of a valve disk or plate 21, arranged to seat on the ring 22 and carried by a stem 23. These stems extend outwardly through the end of the head into exposed position, being provided with the elongated guide bearings 24, within the cage 25. The rods are preferably provided with lubricating grooves 26, within these bearings, which form an efficient packing with practically no friction. The outer end of the valve rod or stem projects through the bonnet 27, and through a screw plug 28, adjustably seated in the outer end portion of the bonnet. The guide bearing member 24 is formed at its outer end with a flanged enlargement constituting a piston chamber 29, the piston disk 30 being secured to the valve rod or stem within said chamber. A spring 31 is seated at one end against the piston disk and at its opposite end against the inner end of the sleeve 28. The space in the chamber 29, above the piston 30 is formed with a vent or outlet 32, controlled by a valve 33, and the space below the piston is provided with a similar vent or outlet 34, controlled by a valve 35.

The operation is as follows: With the parts in the position shown in Fig. 1, the piston 5 has just completed its compression stroke in one direction, and the valves 14, at that end of the cylinder, have been turned in the position shown in Fig. 1, to close the ports 9, said valves moving in the direction indicated by the arrow. It will be noted that in this position of the valve, compressed air at receiver pressure is trapped in the spaces or chambers 12, between the valves 13 and 14, thereby subjecting both sides of the valves 13 to substantially the same pressure in spite of the rapid receding of the engine piston from the valve. This fact, as is known to those skilled in the art, permits the use of very light springs 31, for closing the valves 13, it being necessary that such springs shall have just sufficient strength to overcome the very slight friction of the valves. Inasmuch as the auxiliary valves 14, when properly adjusted, will maintain the ports closed during the return stroke of the piston and until the piston again starts on its next stroke, it will be readily seen that the valves 13 can close very slowly and without the pounding or hammering which occurs in these valves, when no cushioning devices are used. The valves 14 in the meantime prevent any slip or back-rush of the air from the outlet sides of the valves 13, back into the cylinder and also prevent the trapped air in the spaces or chambers 12 from entering said cylinder at the beginning of the return stroke. In case of misadjustment of valves 14, the cushion space 29 prevents injury to the valves. The ports 9 constitute substantially the entire

clearance spaces at the ends of the cylinder, and these ports being extremely short, there is very little air left therein to be reëxpanded into the cylinder at the beginning of the inlet stroke. The valves 14 being closed at the beginning of this stroke and until the piston has moved sufficiently far to expand the air in the ports 9 to substantially atmospheric pressure, there can be no out-rush of the compressed air from the clearance spaces. This out-rush when permitted is very objectionable, since it is desirable that the cylinder shall begin to fill at an early point in the inlet stroke, and some time is required for the ingoing air to overcome the out-rush of the compressed air.

By the valve arrangement shown, a very short movement of the piston on its inlet stroke will expand the air in the ports 9 to atmospheric pressure, the valves 14 then open to admit air to the cylinder, and the cylinder fills freely and rapidly. The arrangement of the two valves 14 at each end of the cylinder practically doubles the inlet area and insures the flowing in of a maximum volume of air. The inlet valves remain open until the piston reaches the end of its reverse stroke, when they again come to the position shown in Fig. 1, and shortly after the reverse stroke commences, the ports 17 come into line with the ports 9. The trapped air in the spaces 12 will then escape into the cylinder, and increase the volume of air therein to this extent. When a point is reached in the compression stroke where the compression is sufficient to overcome the pressure at the discharge valves 13, these valves open automatically. The action of the valves 13 can be readily determined by inspection and their throw determined by measurement of the movement of the outer ends of the valve rods or stems. If the valves are found to be working unequally, the plug 28 of any valve can be screwed in or out to change the tension of the spring 31 to give the proper action to that valve. The valves 33 and 35 can also be regulated to vary the dash-pot effect in either direction of the piston 30 in the chamber 29. This close adjustment and regulation of the valves is made possible by the fact that the oil groove packing is practically frictionless and does not cause the valves to stop in midstroke by binding of a packing. It can be effected without stopping the engine and constitutes one of the many important features of my invention.

The advantages of my invention will be readily understood by those skilled in the art from the foregoing description. The valve arrangement and movement is extremely simple in its character, and the objects of the invention, as heretofore stated, are accomplished in a highly efficient manner, enabling the blowing engine or compressor to be operated at a higher speed than has heretofore been possible and with a maximum mechanical and volumetric efficiency.

It will be understood that various changes can be made in the details of construction and arrangement, without departing from my invention. Thus, the precise form and arrangement of the combined inlet and auxiliary discharge valves together with the means for actuating the same may be varied, and different forms of automatic discharge valves and cushioning means therefor, may be employed.

What I claim is:—

1. A blowing engine or compressor, having two rotary valves in each of its heads, one at each side of the piston rod, said valves being used for both inlet and discharge, actuating connections arranged to positively operate the two valves in each head simultaneously and the valves in the two heads oppositely, and automatic discharge valves located in the discharge ports or passages of the compressor beyond the rotary valves; substantially as described.

2. A blowing engine or compressor, having chambered heads, provided with transverse partitions forming separate inlet chambers, a port leading from each of said chambers to the cylinder, a rotary valve having a seat in each of said ports, there being a discharge port leading from each seat, and the rotary valves having both inlet and outlet ports, automatic valves controlling the discharge ports, and connections for positively actuating the two rotary valves in each head similarly and substantially simultaneously and the two sets of valves oppositely; substantially as described.

In testimony whereof, I have hereunto set my hand.

GEORGE MESTA.

Witnesses:
J. O. HAWLEY,
G. E. TOWNSEND.